

THE USES OF HEVEA FOR FOOD IN RELATION TO ITS DOMESTICATION

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The domestication of plants involves many factors about which there is little direct information. Many of our most useful plants originated so long ago that we do not know their exact geographical origin or the plant or plants from which they were derived. Modern man, in his short span of keeping accurate records, can turn to few examples which offer the complete history of the domestication of a plant. *Hevea* is one plant which is being domesticated in a modern world by reason of its recent value as the world's most economical rubber producer. Its history is so short as scarcely to have changed the plant from its role as a wild jungle tree; yet it will serve as an example from which we may gain further insight into ancient plant domestication.

How do plants become domesticated? To the uninitiated this question may seem too simple for serious consideration. But if it is so simple why are our best research men still in a controversial quandry regarding the origin of maize and most of our other cereals? We may say that plants become domesticated by man through countless generations of cultivation and conscious or unconscious selection of the best-yielding or most adaptive individuals for further propagation. As far as it goes, this may be true but it does not take into account the effects that wild forage animals may have had upon domestication. Little is known of the effect of gradual and catastrophic changes in ecology caused either by man or nature. Seldom can all of the possible factors concerning seed and plant distribution be accurately reconstructed. We must contend with such difficult factors as long-past chance hybridizations and mutations in a plant's history of domestication.

The domestication of a wild plant is brought about by its being taken from its native habitat and reproduced for successive generations under man-modified conditions. Some species have been cultivated in different regions for different reasons at different times. What has happened when two or more of these closely related strains have been brought together? Evidence of such appears in maize literature (Anderson, '46). There are distinct strains of flax, one for seed oil, the other for fibre, certainly an important factor to be considered. The nature of a wild plant may become so changed through the long and complicated process of domestication that it can no longer survive without the aid of man. What would become of the domesticated plants which must rely on man for survival and without which man could not survive?

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How has *Hevea* become domesticated? As a rubber-producing plant, it was taken from the lower Amazon valley to the Far East, seventy-one years ago, into a completely new environment without its indigenous diseases and pests. *Hevea* is a tree crop requiring about ten to fifteen years from seed germination to proven optimum rubber yield. Through selective seed propagation and vegetative budding the average annual yields of seedling trees have been increased from about 350 pounds per acre to above 1500 pounds for bud-grafted trees. This is a remarkable improvement. But, one can scarcely call *Hevea* a highly domesticated plant when comparing its generations of cultivation with those of potatoes or the cereals.

The story of *Hevea* domestication has been often repeated in literature during the past few years. Its most recent chapter concerns the return of the tree to its original home (back to its indigenous diseases and pests) for the development of a Latin American rubber industry through the cooperative sponsorship of the U. S. Department of Agriculture and various Latin American countries (Brandes, '47). This is not the entire history of domestication through which *Hevea* has passed and is passing. Nor is its domestication wholly concerned with a basis of drop-by-drop rubber latex yield from the incised bark.

The domestication of a semi-wild *Hevea* as a food source also must be taken into consideration. There are indications that in its Amazonian home the *Hevea* tree may first have been known to the pre-Columbian aborigine as a nut tree. Probably from acquaintance with *Hevea* as a source of food, the Indian in time learned that certain of these trees produced, through injury to the bark, a substance which could be made into waterproof objects. No doubt one of these objects at some time fell into the fire and the material was seen to burn readily. From this he may have learned that the latex when placed in smoke would coagulate rapidly into a more durable material than when allowed to coagulate naturally. This substance, latex, in its coagulated form, rubber, was destined to overshadow the trees' local value and use for a food.

The celebrated Amazonian plant collector, Richard Spruce, gives the following account, quoted by Bentham (1854):

Siphonia [*Hevea*].—This genus seems abundant throughout the Amazon and its tributaries, but not all the species yield caoutchouc (or Xeringue, as it is here called) of good quality. . . . The wood in all is soft, soon decaying. The seeds are an excellent bait for fish. Macaws eat them greedily, but to man and quadrupeds they are poisonous in a fresh state. The Indians on the Uaupés render them eatable in this way: after being boiled twenty-four hours, the liquor is strained off, and the mass that remains has something the colour and consistence of rice long boiled. Eaten along with fish it is exceedingly savoury.—R. Spruce, MS.

Baldwin ('47) has confirmed the use of *Hevea* seeds for food by the Indians along the Río Negro. It appears also that the seeds of *Cunuria*, a genus closely allied to *Hevea* (and reputed to have hybridized with it), are prepared and eaten by the Indians of the same general region according to Spruce, as reviewed by Baldwin and Schultes ('47).

The pre-Columbian ancestry of both the Carib and later the Arawak Indians inhabiting the great Amazon tributary, the Río Negro, indicates several centuries

of river transportation and primitive agriculture to have existed within the Amazon valley (Radin, '42) and that, furthermore, intercourse existed between the Río Negro and the Orinoco drainage via the Casiquiare. It is becoming evident that a number of plants, of which I feel the "Peach-palm," *Guilielma Gasipaes* (HBK.) Bailey, may prove to be the classic example, may have been distributed from their native homes on the eastern slopes of the Andes through the Amazon valley (Seibert, '47). By way of the Río Negro and Orinoco they eventually became introduced through the West Indies to Central America. As in *Guilielma*, where seed viability lasts for a long time and where growth requirements are not so exacting, a distribution of this sort might quite likely have been carried on by the Indians. Furthermore, *Guilielma* was and is a more important tree in the economy of these Indians than is usually realized. Its fruit is a source of abundant and nutritious food; its wood furnishes one of the finest materials for bows and arrow-points known; its spines make good needles; its leaves, a usable thatch; and the heart of the palm, an excellent food.

In the case of *Hevea*, seed viability lasts only a few days, or at most a few weeks when specially packed. Although establishment of the seedlings is extremely difficult under all but the best of conditions, nevertheless within the Amazon valley itself *Hevea* was and is often transplanted from jungle to doorstep by many an Indian. As a food source in that region it was an important plant where native food plants are exceedingly rare, but it probably was not worth the effort transporting it to regions where food was no such problem as on the Río Negro. As a rubber-producing plant the Indian, in all probability, relied not on *Hevea* but on *Castilla*, which for his needs and crude methods of tapping was far superior. *Castilla* inhabited Central America, the West Indies, and the Amazon valley, so he had no need for transporting a rubber plant—or did he have something to do with the distribution of *Castilla* as well?

Schultes ('45), from individual observations in the Río Negro region, confirms the evidence from herbarium material that this region of the Amazon valley contains more species of *Hevea* and with greater variability within species than any other region thus far known. Transportation being difficult except along streams, collections from that area have largely been obtained from camp-sites, the edges of villages, and from clearings easily accessible. It is quite likely that our collections of *Hevea* from this and other regions are composed of much material originally planted by the Indians and from progeny of those planted trees, hybridized with the local jungle trees, which have sprung up in ancient and recent clearings.

Man along the Amazon has unconsciously and inconspicuously been changing the natural habitat of *Hevea* along the main waterways for centuries. He has made conditions under which interspecific hybridization within *Hevea* has been greatly facilitated and encouraged over large areas. He has aided in obscuring some distributional patterns along the rivers and certainly has contributed to many

perplexing cases of introgression (Seibert, '47). Through this he probably has done more than we realize to cause the extreme variability of *Hevea* found along the Río Negro. As far as I am able to learn from material seen, this variability reaches a very high degree in *Hevea pauciflora* (Spruce ex Benth.) Muell.-Arg. *H. pauciflora* appears as a major constituent in most of the hybrids and hybrid swarms along the upper Amazon proper and the Río Negro, evidently having hybridized with most of the other species of that region. This species is causing the most taxonomic discordance and it appears to have the greatest variation in seed size (Seibert, '47). It may be possible that *H. pauciflora* was the species which the Indians preferred as a nut tree and consequently attempted most often to domesticate. The rubber is very poor, and in hybrids originating from it as one parent, this characteristic seems to predominate. *H. pauciflora* is outstanding, however, in its resistance to the virulent South American Leaf Blight, *Dotydia Ulei* P. Henn. The Río Negro, though abundant in species and variations, is not known as a superior rubber-producing area, though it may prove to be highly significant as a region of outstanding disease-resistant strains.

Hevea has aided man in his advance in civilization. A study of its early history as a wild and cultivated nut tree is resulting in information useful in the task of improving commercial planting material of the *Hevea* rubber tree. It is not too optimistic to prophesy that modifications of its original jungle use may again be taken up as by-products of commercial plantings. Further experimental work is needed to test the qualities of these by-products. The seed kernels contain a high percentage of oil which is chiefly used in soap, but, being quick-drying, would also be of value in the paint industry. Stock feed and fertilizer may be manufactured from the remaining seed pulp (Jamieson, '43).

SUMMARY

1. Through its value as a food plant to the Indians of the Río Negro region, it appears that *Hevea* became a semi-domesticated tree.
2. Its domestication along the major waterways in clearings, edges of villages, and camp-sites followed a pattern of conscious or unconscious selection for seed production.
3. The planting of certain species in the vicinity of other wild species substantially aided the process of interspecific hybridization.
4. The spot-clearing and shifting type of agriculture practiced along the rivers for centuries resulted in types of habitats ideal for the growth and development of interspecific hybrids and hybrid swarms.
5. Once established in clearings the mature hybrids and introgressive hybrids are (at least in part) capable of competing with the encroaching second growth.
6. Several centuries of this slow process seem to have played a conspicuous part in the resultant hodge-podge of variables turning up as representative collections of *Hevea* from the Río Negro.

7. The "Peach-palm, *Guilielma Gasipaes*, may prove to be a classic example of the extent to which a tree has become domesticated in the Amazon valley, passing from Indian tribe to Indian tribe, from region to region, eventually reaching the West Indies and Central America.

8. From present evidence it appears that *Hevea pauciflora* has been the species of *Hevea* most cultivated by the Indians of the Río Negro and upper Amazon.

9. The Río Negro region is not outstanding as a region of high rubber yield or quality.

10. The past history of semi-domestication of *Hevea* in the Río Negro region may be significant in having strengthened disease resistance within certain species of that region.

11. The seeds of *Hevea* are a potential source of economic products useful to man.

12. Many of our cultivated plants probably had similarly complex histories.

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